MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2017/2018

DCS5028 – DISCRETE STRUCTURES

(All sections / Groups)

6 MARCH 2018
9.00 a.m – 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This examination paper consists of **5** pages.
2. There are **4** structured questions.

FOUR STRUCTURED QUESTIONS (TOTAL: 100 Marks)
Answer all questions and show necessary workings in the answer booklet provided.

QUESTION 1 (25 Marks)

A. For propositions **K** and **M** given below, determine if they are logically equivalent or not.

$\mathbf{K} = (p \vee \neg q) \leftrightarrow (r \wedge \neg p) \vee (r \vee \neg p)$, $\mathbf{M} = (\neg p \vee q) \wedge (r \wedge q) \rightarrow (p \vee \neg q)$

[8 Marks]

B. Let P(y) be the propositional function $y \leq 2 - y$. The domain of discourse is the set = { y | 0 < y < 6}. Write each proposition below in words and tell whether each proposition is **TRUE** or **FALSE.**

I. $\forall y P(y)$ [2 Marks]

II. $\exists y P(y)$ [2 Marks]

III. $\neg(\forall y P(y))$ [2 Marks]

C. Let the Universal Set, U = { x | 0 < x < 21 }. Let A = {2,3,4,5,8,17,18}, B = {1,2,3,4,10,11,12} and C = {2,4,6,7,8,9,10,11,19,20}.

I. $C \cup (A \cap B)$ [2 Marks]

II. $(\overline{A} \cap B) \cup C$ [2 Marks]

III. $(B \cap \overline{C}) \cap A$ [2 Marks]

D. Given M = {x | 0 < x < 4} and N = {y | 14 < y < 18} where f is the function from M to N. Let $f(1) = 15$, $f(2) = 16$ and $f(3) = 17$. Draw its arrow diagram and find its domain and co-domain. Determine if it is injective, surjective and bijective. [5 Marks]

Continued...

QUESTION 2 (25 marks)

A. Use a mathematical induction to prove that

$$S_n = 1 + 5 + 9 + 13 \ldots + (4n - 3) = n(2n - 1)$$

is true for all positive integers. [8 Marks]

B. By using the Euclidean Algorithm, find:

I. GCD for the numbers of 225 and 115. [2 Marks]

II. The value of s and t satisfying that $225s + 115t = \text{GCD}(225, 115)$. [3 Marks]

III. LCM (225, 115) [2 Marks]

C. Consider the following function. [6 Marks]

```
int curve(int y)
{
   if (y == 0)
      return 0;
   else
      return (curve(y – 1) + (y + 3));
}
```

Show the tracing process to derive the result by this function call: **curve (5)**.

D. How many student's ID passwords can be made if the first 2 entries must be letters, followed by 5 numbers, under the following condition:

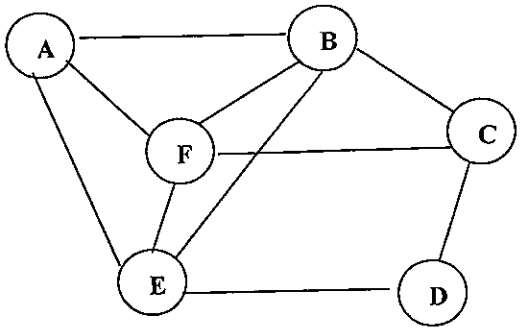
I. with repetition [2 Marks]

II. without repetition [2 Marks]

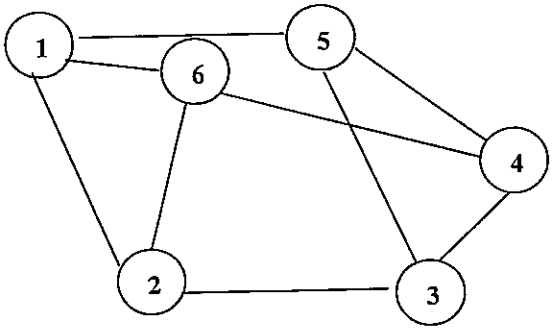
Continued...

QUESTION 3 (25 marks)

A. Determine if the graphs **G1** and **G2** are isomorphic. Justify your answer. [3 Marks]



G1



G2

B. Determine if graph **G1** is a complete graph. [4 Marks]

C. Given an Adjacency Matrix:

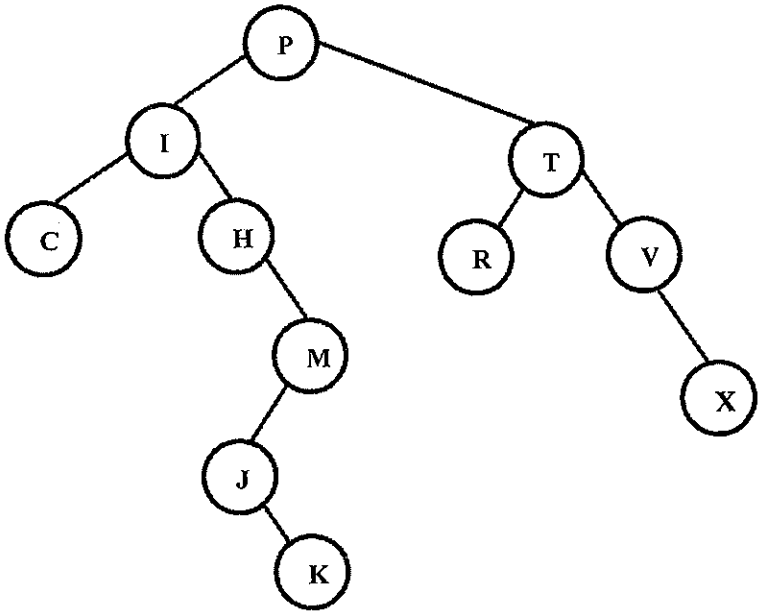
	A	B	C	D	E	F
A	0	1	1	0	1	1
B	1	0	0	1	1	0
C	1	0	0	1	0	1
D	0	1	1	0	1	0
E	1	1	0	1	0	1
F	1	0	1	0	1	0

I. Draw the graph according to the given Adjacency Matrix. [5 Marks]

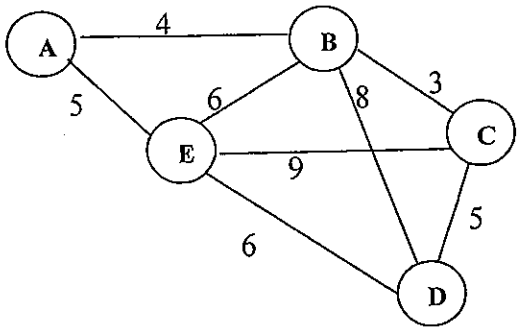
II. Determine whether the graph drawn in Question C(I) is a bipartite. Give your reason. [3 Marks]

Continued...

D. Derive the order in which the binary tree is processed using *preorder* and *postorder* traversal. [6 Marks]



E. Use *Kruskal*'s algorithm to find the minimal spanning tree for the weighted graph M. What is the total minimum weight? [4 Marks]



Graph M

Continued...

QUESTION 4 (25 marks)

A. Construct circuits that produce the following outputs:

I. $(x \vee y'z)'$ [4 Marks]

II. $(x \oplus y) \vee z'y$ [5 Marks]

B. Draw the Karnaugh Map for the optimal boolean expression below and write the minimized expression.

I. $kt \vee mnk \vee k'mn \vee k'mn' \vee ktmn' \vee kt'm'n$ [4.5 Marks]

II. $pqr \vee pqr's \vee pr's' \vee p'rs \vee p'q \vee pq'r's$ [4.5 Marks]

C. Given a finite state machine, M = (I, O, S, f, g, S_1), I = {a,b}, O ={0,1}, S= { S_1, S_2, S_3}, draw the transition diagram based on the state table shown below: [5 Marks]

	f		g	
S \ I	a	b	a	b
S_1	S_1	S_2	0	0
S_2	S_2	S_3	0	1
S_3	S_3	S_2	1	0

D. Redraw the transition diagram in Question 4(C) as the transition diagram of a finite-state automaton. [2 Marks]

End of Paper.